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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/871,463	05/31/2001	Charles R. Spinner III	01-P-002 (STMI01-00013)	9805

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EXAMINER
WARREN, MATTHEW E

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 11/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/871,463	Applicant(s) SPINNER III, ET AL.	
	Examiner Matthew E. Warren	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *27 August 2002* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action is in response to the Amendment filed on August 27, 2002.

Drawings

The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on August 27, 2002 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 8, 9, 11, and 16-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Gillespie (US 6,175,154 B1).

Gillespie shows (fig. 1f) a portion of an integrated circuit comprising a dielectric layer (3) over a substrate (1), a conformal tungsten layer (9) over the dielectric layer and within openings of the dielectric layer, and a protective barrier layer (11) over the

tungsten layer and within the opening. The protective barrier layer is a nitride (such as titanium nitride) or a refractory metal (titanium is known to be a refractory metal) and therefore inherently comprises a material for which removal by mechanical polishing is primarily mechanical. The barrier layer overlies the entire tungsten layer

Claims 8-14 and 16-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Marcyk et al. (US 6,103,625).

Marcyk et al. shows (fig. 3A) a portion of an integrated circuit comprising a dielectric layer (302) over a substrate (300), a conformal tungsten layer (304) over the dielectric layer and within openings of the dielectric layer, and a protective barrier layer (308) over the tungsten layer. The protective barrier layer is formed over the tungsten layer within a region or within the boundaries of the contact hole and therefore is formed "within" the opening. The protective barrier layer is a nitride (such as titanium nitride) or a refractory metal (titanium is known to be a refractory metal) (col. 5, lines 19-30) and therefore inherently comprises a material for which removal by mechanical polishing is primarily mechanical. The portion of the tungsten layer in the opening is thicker than the portion of the tungsten layer over the dielectric layer. The barrier layer overlies the entire tungsten layer. In another embodiment (fig. 3B) the barrier layer (308) only overlies portions of the tungsten layer within the opening but not portions over the dielectric layer. In one embodiment, the conductive layer (tungsten layer) has a thickness between 4500 and 8000 Angstroms (col. 3, lines 61-62) and the barrier layer has a thickness between 100 and 800 Angstroms (col. 4, lines 22-23).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 15 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marcyk et al. (US 6,103,625) as applied to claims 8 and 16 above, and further in view of Van Buskirk et al. (US 6,346,741 B1).

Marcyk shows all of the elements of the claims except the opening in the dielectric being sized to form a capacitive electrode from the tungsten within the opening. Van Buskirk et al. shows. (fig. 1H) shows a capacitor device comprising a tungsten electrode contact (18) and a tungsten top electrode (44) formed in dielectric layer (18 and 35) openings. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the tungsten interconnect of Marcyk by incorporating that interconnect as a capacitor electrode because Van Buskirk teaches that tungsten interconnects suitably function as capacitor electrodes.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marcyk et al. (US 6,103,625) as applied to claim 16 above, and further in view of Joshi et al. (US 5,889,328).

Marcyk shows all of the elements of the claims except the tungsten and barrier layer form an upper surface which is planar with an upper surface of the dielectric layer.

Joshi et al. shows (fig. 7B) shows an interconnect structure in which a low resistive metal layer (16) (which includes tungsten) and capping layer (17) (being titanium is formed in a via hole and is coplanar with an upper surface of a dielectric layer (15) (col. 10, lines 13-30). Such a configuration results in conductors that are corrosion-free, resist electromigration wear, and reduced cumbersome dielectric planarization steps (col. 3, lines 50-55). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the tungsten interconnect of Marcyk by forming the tungsten and titanium barrier layer to be coplanar with an upper surface of a dielectric layer as taught by Joshi to form conductors that are corrosion-free, that resist electromigration wear, and have minimal dielectric planarization steps.

Response to Arguments

Applicant's arguments filed with respect to claims 8 and 16 have been fully considered but they are not persuasive. The applicant primarily asserts that the prior art references do not show all of the elements of the claims, specifically that the barrier layer is not within the opening and is not formed of a material which chemical mechanical polishing is primarily mechanical. The examiner believes that the cited references show all of the elements of the claims. With respect to the arguments that the cited art does not show that the barrier layer is within the opening, the examiner believes that Gillespie shows that a portion of TiN layer 11 in figure 1f is over tungsten layer 9 and partially within the opening. The layer 11 may not be formed in the opening in the same manner as the layer 109 of the claimed invention (figure 1b), however

because portions of the layer 11 of Gillespie are within the opening, the cited art shows the limitation. Furthermore, the examiner broadly interprets the limitation of the "protective barrier layer...within the openings" to mean that the barrier layer is formed within a region of the opening defined by vertical boundaries of the hole. This means that the barrier layer does not specifically have to be formed in the depths of the opening or extend below the upper surface of the dielectric (or tungsten). It is true that the barrier layer (308b) of Marcyk et al. does not extend within the depths of the opening, but because the barrier is formed within a boundary of the opening, the barrier layer is "within" the opening.

With respect to the arguments that the references do not show the barrier layer being a material which chemical mechanical polishing is primarily mechanical, the examiner believes that because the materials of the cited references are the same materials disclosed in the applicants claimed invention, then the references disclose such a material. The fact that the applicant's invention uses TiN as the barrier which has the property that chemical mechanical polishing is primarily mechanical means that another invention using TiN also has the same property because such a property is common or inherent to that material. Therefore the cited references show all of the elements of the claims and this action is made final.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (703) 305-0760. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

MEW
MEW
November 18, 2002

EDDIE LEE
SUPERVISORY PATENT EXAMINER
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